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An Old-Growth Definition for Tropical and Subtropical Forests in Florida

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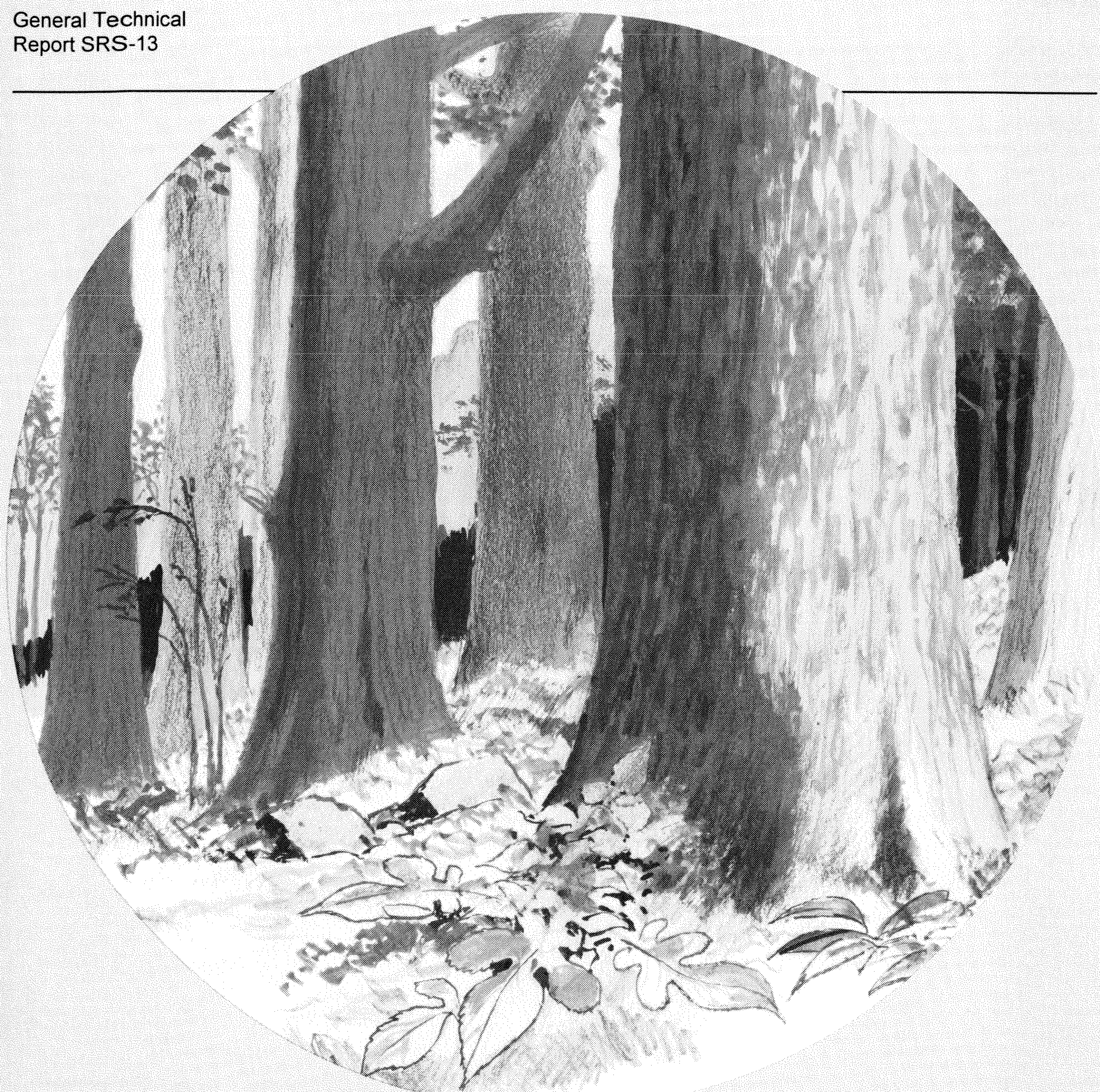

A Section of the Old-Growth Definition Series

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Preface

Old growth is widely acknowledged today as an essential part of managed forests, particularly on public lands. However, this concept is relatively new, evolving since the 1970's when a grassroots movement in the Pacific Northwest began in earnest to define old growth. In response to changes in public attitude, the U.S. Department of Agriculture, Forest Service, began reevaluating its policy regarding old-growth forests in the 1980's. Indeed, the ecological significance of old growth and its contribution to biodiversity were apparent. It was also evident that definitions were needed to adequately assess and manage the old-growth resource. However, definitions of old growth varied widely among scientists. To address this discrepancy and other old-growth issues, the National Old-Growth Task Group was formed in 1988. At the recommendation of this committee, old growth was officially recognized as a distinct resource by the Forest Service, greatly enhancing its status in forest management planning. The committee devised "The Generic Definition and Description of Old-Growth Forests" to serve as a basis for further work and to ensure uniformity among Forest Service Stations and Regions. Emphasis was placed on the quantification of old-growth attributes.

At the urging of the Chief of the Forest Service, all Forest Service Stations and Regions began developing old-growth definitions for specific forest types. Because the Southern and Eastern Regions share many forest communities (together they encompass the entire Eastern United States), their efforts were combined, and a cooperative agreement was established with The Nature Conservancy for technical support. The resulting project represents the first large-scale effort to define old growth for all forests in the Eastern United States. This project helped bring the old-growth issue to public attention in the East.

Definitions will first be developed for broad forest types and based mainly on published information and so must be viewed accordingly. Refinements will be made by the Forest Service as new information becomes available. This document represents 1 of 35 forest types for which old-growth definitions will be drafted.

In preparing individual old-growth definitions, authors followed National Old-Growth Task Group guidelines, which differ from the standard General Technical Report format in two ways—the abstract (missing in this report) and the literature citations (listed in Southern Journal of Applied Forestry style). Allowing for these deviations will ensure consistency across organizational and geographic boundaries.

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Introduction

In the United States, tropical and subtropical forests are found only in south Florida, covering the southern part of the Floridian Coastal Plain and the Florida Keys. The climate is typically hot and humid with abundant rainfall, although droughts do occur. Soils range widely depending on landform and parent material, and can be organic, fine-textured silts, or coarse-textured sands. These forests develop best on moist hammocks with organic soils. They are the stable climax vegetation on the slightly higher portions of the landscape where fire is infrequent. South Florida slash pine (*Pinus elliottii* var. *densa* Little & Dorman) dominates areas with more frequent fires with the fire-sensitive subtropical and tropical hardwoods restricted to subordinate positions. Lower wet areas are occupied by cypress, saw grass, or wet prairie communities.

Physical Environment

Geographic Distribution

Tropical and subtropical forests correspond to Society of American Foresters cover type 105 (Eyre 1980). In the United States, these forests grow only on the Florida section of the coastal plain physiographic province (Fenneman 1938) and on the Florida Keys. They are most common in Dade, Monroe, and Collier Counties (Woodall 1980) with extensions farther north near the coast where ocean waters mediate freezing temperatures (Simpson 1920). Within this region, these forests occupy areas of the Miami rock ridge, the Keys, the Everglades, the Florida Bay coast, and the gulf coast. This community occupied about 25,000 acres (ac) [10,000 hectares (ha)] in pre-Columbian times (Woodall 1980).

Geologic Substratum

The Miami rock ridge, an outcropping of Miami oolite limestone (Craighead 1971), extends down the Atlantic coast through Miami south and west through Homestead to the Long Pine Key area of the Everglades. Elevations range from more than 23.0 feet [7 meters (m)] above sea level near Miami to 13.0 feet (4.0 m) near Homestead and 6.5 feet (2.0 m) or less around Long Pine Key (Snyder et al. 1990). The upper Keys are islands of coral rock (Key Largo limestone) formed during the Pleistocene age, while the lower Keys are oolitic limestone (Craighead 1971). The Everglades, often referred to as the river of grass, is a large expanse of wetlands dominated by saw grass that stretches south from Lake Okeechobee behind the Atlantic coast ridge. The Florida Bay and gulf coasts are mostly low, wet areas dominated by mangrove forest and coastal marsh.

The Miami rock ridge has an extremely rough, irregular surface pitted by solution holes. Pine lands, dominated by south Florida slash pine, cover most of this area. Tropical and subtropical hammocks generally occupy the higher areas, but the difference in elevation is difficult to detect because it is actually only a few inches (Alexander 1967). A more prominent feature of tropical hammocks is the presence of numerous solution holes, ranging in diameter and depth from 1.5 to 8.0 feet (0.5 to 2.5 m) (Small 1909), created by organic acids dissolving the limestone (Craighead 1974). All the higher areas on the Keys north of Bahia Honda were once covered by tropical hardwood forests (Gifford 1911). In the Everglades, tropical and subtropical forests form teardrop-shaped tree islands (Carr 1973). These tropical hardwood hammocks occur where organic matter has accumulated on platforms of the underlying limestone, which are slightly higher, 1 to 4 feet (0.3 to 1.0 m), than the general area. Along the coast of Florida Bay, tropical and subtropical hardwoods grow on storm-deposited embankments and shell mounds (Olmsted et al. 1981). In the gulf coast region, these forests occupy the high ridges, outcrops of Tamiami limestone, which are scattered throughout the area (Craighead 1971). Although these communities are often surrounded by water, they are rarely inundated (Schomer and Drew 1982).

Soils

Because of fluctuations in sea level (most recently 5,000 to 8,000 years ago) soils for the entire area are of recent origin. These soils are mostly calcareous muds or organic deposits mixed with shell remains (Craighead 1971), although some areas of the coast have soils derived from storm-deposited sands. Soils are thin layers over the irregular, porous, limestone rock, with hardwood hammock soils being generally deeper and having a higher organic matter content than those of adjoining pine lands (Wade et al. 1980). Much of the actual soil material accumulates in channels, fissures, and depressions in the bedrock.

Climate

The region has a subtropical climate with about a 15 °F (8 °C) range between mean summer highs and winter lows (Craighead 1971). Killing frosts occur as far south as Miami about once every 5 years, while summer maximums seldom exceed 94 °F (34 °C) (Davis 1943). There is a distinct summer, wet season from May to October, when 60 to 80 percent of the rainfall occurs, followed by a 6-month winter, dry season. Annual rainfall is highest along the Atlantic coast, averaging 60 inches [1524 millimeters (mm)] from Miami to West Palm Beach. Inland precipitation drops to 55 inches (1397 mm) over Lake Okeechobee and the Everglades around Homestead. Mean annual rainfall declines farther both south and west of Homestead, averaging 50 inches (1270 mm) in the upper Keys and along the southwest coast and about 40 inches (1016 mm) at Key West. Wet-season rainfall comes from frequent, convective thunderstorms accompanied by locally high winds and lightning, while winter precipitation comes from the passage of cold fronts (Schomer and Drew 1982).

General Vegetation

Hammock Origin

Live oak (*Quercus virginiana* Mill.) is often a pioneer species in hardwood hammock development on the Miami rock ridge, commonly occurring near solution holes, which provide water storage and fire protection (Sand 1971). As other species invade, a closed canopy forms, dominated by trees with crooked trunks, dense hardwood, and stiff evergreen leaves (Harper 1927). These trees produce a dense canopy that modifies the microclimate to a moister and shadier environment (Carr 1973, Olmsted et al. 1983). Other early successional species are wild-tamarind [*Lysiloma latisiliquum* (L.) Benth.] and mahogany (*Swietenia mahagoni* Jacq.), which do not reproduce in shade but are prevalent in hammocks because of disturbance from fire and storms (Robertson 1962).

Species Composition

Hammocks are dominated by mostly broad-leaved, evergreen trees of West Indian origin and a few temperate species (Craighead 1974). This is a diverse community containing 150 to 170 native species of trees and shrubs (Snyder et al. 1990). Species richness is greatest in the large hammocks, such as those in the Long Pine Key area of Everglades National Park. Because of landscape diversity and differences in species distribution, composition varies greatly, but nearly all hammocks contain gumbo-limbo [*Bursera simaruba* (L.) Sarg.] and pigeon-plum (*Coccoloba diversifolia* Jacq.) in the canopy and stopper (*Eugenia* spp.) in the midstory and understory layers.

Other common canopy species found in many hammocks include poisonwood [*Metopium toxiferum* (L.) Krug & Urban], willow bustic [*Dipholis salicifolia* (L.) A. DC.], strangler fig (*Ficus aurea* Nutt.), wild-tamarind, mastic [*Mastichodendron foetidissimum* (Jacq.) H.J. Lam], live oak, and cabbage-palm [*Sabal palmetto* (Walt.) Lodd ex J.A. & J.H. Schult]. Temperate species are less common in hammocks on the Florida Keys (Schomer and Drew 1982), while some tropical species such as black-ironwood [*Krugiodendron ferreum* (Vahl) Urban], Jamaica-dogwood [*Piscidia piscipula* (L.) Sarg.], and thatchpalm (*Thrinax morrisii* H. Wendl.) are more common. Other trees, such as lignum vitae (*Guaiacum sanctum* L.) and milkbark (*Drypetes diversifolia* Krug & Urban), grow only in the Keys. Hammocks in western Florida generally have fewer species; and the canopy is more likely to be dominated by one or a few species (Craighead 1971).

Although there are several species in the canopy, most of the woody species in a hammock community occur in the midstory and understory layers (table 1). Hammocks contain few herbaceous species (Snyder et al. 1990), having a clean forest floor composed of leaflitter (Small 1916). Olmsted et al. (1980) reported herbaceous cover, including tree seedlings to be 1 to 5 percent, except in canopy gaps. Epiphytes (e.g., ferns, bromeliads, and orchids) are common around solution holes and canopy gaps where light is prevalent (Carr 1973). Air plants are less prevalent on the Keys because of a drier climate.

Natural Disturbance

Frosts, droughts, fires, and tropical storms significantly stress the vegetation of south Florida hammocks (Richardson 1977). Most species, however, are well adapted to these natural forces as shown by the stable species composition during a 25-year period reported by Alexander (1967) for a hammock near Miami. The dense canopy of hammocks acts like a natural greenhouse, keeping the interior warmer in winter, which limits most frost damage to the edge (Craighead 1974). The closed

Table 1—Major tree species of tropical and subtropical hammocks of Florida[a]

Position[b]/scientific name	Common name	Range[c]	Type
Overstory:			
Annona glabra L.	Pond-apple	All[d]	Tropical
Bursera simaruba (L.) Sarg.	Gumbo-limbo	All	Tropical
Coccoloba diversifolia Jacq.	Pigeon-plum	All	Tropical
Dipholis salicifolia (L.) A. DC.	Bustic	All	Tropical
Ficus aurea Nutt.	Strangler fig	All	Tropical
Ficus citrifolia Mill.	Shortleaf fig	All	Tropical
Lysiloma latisiliquum (L.) Benth.	Wild-tamarind	All	Tropical
Manilkara bahamensis (Baker) Lam & Meeuse	Wild-dilly	LG,K	Tropical
Mastichodendron foetidissimum (Jacq.) H.J. Lam	Mastic	All	Tropical
Metopium toxiferum (L.) Krug & Urban	Poisonwood	MR,EG,K	Tropical
Morus rubra L.	Mulberry	MR,EG	Temperate
Persea borbonia (L.) Spreng.	Redbay	All	Temperate
Quercus virginiana Mill.	Live oak	All	Temperate
Roystonea elata (Bartr.) F. Harper	Royalpalm	EG,GC	Tropical
Sabal palmetto (Walt.) Lodd ex J.A. & J.H. Schult	Cabbage-palm	All	Temperate
Sapindus saponaria L.	Soapberry	EG,K,GC	Tropical
Simarouba glauca DC.	Paradise-tree	All	Tropical
Swietenia mahagoni Jacq.	Mahogany	EG,K	Tropical
Midstory:			
Amyris elemifera L.	Torchwood	MR,K	Tropical
Ardisia escallonioides Schiede & Deppe ex Schlecht.& Cham.	Marlberry	All	Tropical
Byrsonima lucida DC.	Locust-berry	EG,K	Tropical
Canella winterana (L.) Gaertn.	Wild-cinnamon	K,GC	Tropical
Cephalanthus occidentalis L.	Buttonbush	All	Temperate
Chrysobalanus icaco L.	Cocoplum	All	Tropical
Chrysophyllum oliviforme L.	Satinleaf	All	Tropical
Citharexylum fruticosum L.	Fiddlewood	MR,EG,K	Tropical
Cordia sebestena L.	Geiger-tree	LG,K	Tropical
Drypetes diversifolia Krug & Urban	Milkbark	K	Tropical
Eugenia confusa DC.	Red stopper	MR,K	Tropical
Exothea paniculata (Juss.) Radlk.	Inkwood	All	Tropical
Guaiacum sanctum L.	Lignumvitae	K	Tropical
Hippomane mancinella L.	Manchineel	LG,K	Tropical
Krugiodendron ferreum (Vahl) Urban	Black-ironwood	MR,EG,K	Tropical
Nectandra coriacea (Sw.) Griseb.	Lancewood	All	Tropical
Persea borbonia var. *pubescens* (Pursh) Little	Swampbay	All	Temperate
Piscidia piscipula (L.) Sarg.	Jamaica-dogwood	LG,K,GC	Tropical
Spondias purpurea L.	Hog plum	Introduced	
Rapanea punctata (Lam.) Lundell	Myrsine	All	Tropical
Schoepfia schreberi J.G. Gmel.	Whitewood	All	Tropical
Tetrazygia bicolor (Mill.) Cogn.	Tetrazygia	EG	Tropical
Understory:			
Bumelia celastrina H.B.K.	Saffron-plum	MR,K,GC	Tropical
Drypetes lateriflora (Sw.) Krug & Urban	Guiana-plum	All	Tropical
Eugenia spp.	Stoppers	All	Tropical
Guapira discolor (Spreng.) Little	Blolly	All	Tropical
Guettarda elliptica Sw.	Velvetseed	MR,EG,K	Tropical
Gymnanthes lucida Sw.	Crabwood	MR,EG,K	Tropical
Hypelate trifoliata Sw.	White-ironwood	EG,K	Tropical
Prunus myrtifolia (L.) Urban	West Indian cherry	EG,UK	Tropical
Psychotria spp.	Wild coffee	All	Tropical
Reynosia septentrionalis Urban	Darling-plum	K	Tropical
Schaefferia frutescens Jacq.	Florida-boxwood	K	Tropical
Trema micranthum (L.) Blume	Florida trema	All	Tropical
Zanthoxylum fagara (L.) Sarg.	Wild-lime	All	Tropical

[a] Based on a compilation of species lists in Alexander (1958, 1967); Austin et al. (1977); Bureau of Land & Water Management (1976); Craighead (1971); Davis (1943); Duever et al. (1982); Gifford (1911); Harper (1927); Harshberger (1914); Olmsted et al. (1980, 1981, 1983); Schomer and Drew (1982); Simpson (1920); and Weiner (1979).
[b] Based on information from Long and Lakela (1976), Scurlock (1987), and Stevenson (1992).
[c] Based on Little (1979).
[d] All = all of south Florida and Keys, EG = Everglades, LG = lower glades, MR = Miami rock ridge, K = Keys, UK = upper Keys, and GC = gulf coast.

canopy, greenhouse effect also mediates moisture losses, reducing the impact of dry periods. In addition, many species (e.g., gumbo-limbo) drop their leaves during dry periods and refoliate when the rainy season begins (Bureau of Land & Water Management 1976). Natural fires start from lightning strikes associated with thunderstorms. Because most thunderstorms occur during the summer (wet season) many of the hammocks are protected by surrounding water, or the organic matter is too moist to carry fires (Craighead 1971). If the peat is dry enough to burn, the soil can be consumed down to bare rock, eliminating the hammock (Schomer and Drew 1982).

High winds from tropical storms frequently strike hammocks, but only very intense storms cause much damage. The closed canopy deflects winds (Duever et al. 1986), and the high density of stems provides a sort of mutual buffering (Bureau of Land & Water Management 1976) that, along with the extensive root system (Small 1922), allows most individuals to resist storm damage. A hurricane with winds exceeding 125 miles per hour (200 kilometers per hour) occurs about every 25 years (Gentry 1974). Winds of this magnitude blow many large trees over and prune all but the largest branches from many others (Craighead and Gilbert 1962). This occurrence opens the canopy, admitting sunlight, which stimulates growth of trees and shrubs. Damage near the coast is much worse from farther inland because of the storm surge. The severest damage, however, is often confined to small areas (Richardson 1977).

Old-Growth Attributes

Size and Composition

Old-growth hammocks, like hammocks in general, are mostly small patches of broad-leaved forest dominated by tropical species and surrounded by other vegetation (Snyder et al. 1990). Hammock size ranges from 0.25 to 100 ac (0.1 to 40 ha) (Craighead 1974), with most being less than 25 ac (10 ha) (Olmsted et al. 1983). A minimum size of 0.6 ac (0.25 ha) is probably required for old-growth development. Species composition of old-growth stands is similar to that for hammocks in general.

Tree Size and Basal Area

Although species such as mastic and mahogany can grow much larger, to be classified as old-growth hammock, the community must have some trees at least 16 inches (40 cm) in diameter (table 2). The largest trees in old-growth hammocks are at least 100 years old with a few individuals 150 years old. Old-growth hammocks on the Miami rock ridge have a well-developed, closed canopy of hardwoods 20 to 33 feet (6 to 10 m) in height, with some large trees 50 to 56 feet (15 to 17 m) in height rising above the general canopy and an understory of tropical trees and shrubs 3 to 16 feet (1 to 5 m) in height (Olmsted et al. 1980, 1983). Maximum heights are less for old growth west and south of Homestead because of lower annual rainfall (Alexander 1958). Basal area in old-growth stands averages about 260 feet^2 per ac (60 m^2 per ha), with a minimum of at least 130 feet^2 per ac (30 m^2 per ha) required.

Microenvironment

The edge of many old-growth hammocks is a dense, jungle-like growth of mostly small stems forming a barrier to the interior (Phillips 1940, Gantz 1971). The interior of old-growth hammocks, however, is composed mostly of old trees with a dense, leafy canopy (Simpson 1920, Carr 1973) that filters out as much as 85 percent of ambient sunlight (Schomer and Drew 1982), creating twilight-like conditions even at midday (Harshberger 1914, Simpson 1920). Because of extreme shade, the herbaceous understory is extremely sparse and composed of few species (Olmsted et al. 1980). The forest floor is clean with an open, almost park-like appearance (Sand 1971, Bureau of Land & Water Management 1976). Most herbaceous growth and epiphytes grow in the occasional canopy gaps. Much of the bird and insect life exists high in the canopy where sunlight is available (Simpson 1920). The solution holes provide a specialized habitat occupied by a lush growth of ferns.

Soil and Forest Floor

A major distinguishing attribute of old-growth hammocks is the accumulation of an organic soil layer that is at least 4.7 inches (12 cm) thick (Olmsted et al. 1980) and can reach depths greater than 12 inches (30 cm) (Small 1909, Simpson 1920, Craighead 1971). This rich, dark, organic layer develops from leaves and detritus of the hardwoods (Gifford 1911), which have an average annual litterfall of 5,370 pounds per acre (6100 kilograms per hectare) (Ross et al. 1992). This accumulation of organic matter conceals much of the underlying rock. The pitted, irregular nature of the substratum, however, is revealed at tip-up mounds, where trees blown over by tropical storms have torn the organic layer from the rock. Because many of the tropical species have dense, decay-resistant woods, fallen timber generously litters the forest floor of old-growth stands (Simpson 1920). Many of the trees can sprout from the base or can send up a branch from their fallen trunk to form a new main stem. Examples of both of these adaptations to tropical storm damage can usually be found in old-growth stands.

Table 2 (English units)—Standardized table of old-growth attributes for tropical and subtropical hammocks of Florida

Quantifiable attribute	Value: Range	Value: Mean	Number of stands	Site[a]	References
Stand density (no./acre)					
Trees ≥1 in d.b.h.	2,090–2,390	2,240	2	EG	Olmsted et al. 1980
Trees ≤1 in d.b.h. and ≥2 ft height	3,370–6,000	4,685	2	EG	Olmsted et al. 1980
Trees ≤2 ft height	65,540–85,250	75,400	2	EG	Olmsted et al. 1980
Trees ›4 in d.b.h.		6,075	1	MR	Alexander 1967
Stand basal area (ft²/acre)					
Trees ›1 in d.b.h.	190–400	300	2	EG	Olmsted et al. 1980
Trees ›4 in d.b.h.		250	1	MR	Alexander 1967
Age of large trees (yrs)					
All species	100–200	150	UN[b]	EG	Tyrell 1992
All species		200	4	EG	Craighead 1971
Swietenia mahagoni Jacq.		225	UN	EG	Wade et al. 1980
S. mahagoni		200	UN	EG	Craighead and Gilbert 1962
Maximum d.b.h. (in)					
All trees	48–72	60	UN	EG	Craighead 1971
All trees	28–36	32	5	EG	Gantz 1971 Olmsted et al. 1980
Bursera simaruba (L.) Sarg.		40	UN		Long and Lakela 1976
B. simaruba		36	UN	UK	Bureau of Land & Water Mgmt. 1976
Ficus aurea Nutt.		60	UN		Small 1929
Mastichodendron foetidissimum (Jacq). H.J. Lam		60	UN		Small 1929
Metopium toxiferum (L.) Krug & Urban		19	1	UK	Author's data
S. mahagoni		60	1	EG	Robertson 1962
S. mahagoni	15–17	16	UN	LG	Olmsted et al. 1981

[a] EG = Everglades, MR = Miami rock ridge, UK = upper Keys, LG = lower glades.
[b] UN = Unknown.

Table 2 (metric units)—Standardized table of old-growth attributes for tropical and subtropical hammocks of Florida

Quantifiable attribute	Value: Range	Value: Mean	Number of stands	Site[a]	References
Stand density (no./ha)					
Trees ≥3 cm d.b.h.	5160–5895	5530	2	EG	Olmsted et al. 1980
Trees ≤3 cm d.b.h. and ≥.6 m height	8325–14820	11570	2	EG	Olmsted et al. 1980
Trees ≤.6 m height	161,835–210,500	186,165	2	EG	Olmsted et al. 1980
Trees >6 cm d.b.h.		15000	1	MR	Alexander 1967
Stand basal area (m^2/ha)					
Trees >3 cm d.b.h.	44–91	68	2	EG	Olmsted et al. 1980
Trees >6 cm d.b.h.		57	1	MR	Alexander 1967
Age of large trees (yrs)					
All species	100–200	150	UN[b]	EG	Tyrell 1992
All species		200	4	EG	Craighead 1971
Swietenia mahagoni Jacq.		225	UN	EG	Wade et al. 1980
S. mahagoni		200	UN	EG	Craighead and Gilbert 1962
Maximum d.b.h. (cm)					
All trees	122–183	152	UN	EG	Craighead 1971
All trees	72–91	82	5	EG	Gantz 1971 Olmsted et al. 1980
Bursera simaruba (L.) Sarg.		100	UN		Long and Lakela 1976
B. simaruba		91	UN	UK	Bureau of Land & Water Mgmt. 1976
Ficus aurea Nutt.		152	UN		Small 1929
Mastichodendron foetidissimum (Jacq). H.J. Lam		152	UN		Small 1929
Metopium toxiferum (L.) Krug & Urban		48	1	UK	Author's data
S. mahagoni		150	1	EG	Robertson 1962
S. mahagoni	37–42	40	UN	LG	Olmsted et al. 1981

[a] EG = Everglades, MR = Miami rock ridge, UK = upper Keys, LG = lower Glades.
[b] UN = Unknown.

Indicator Species

Live oak, wild-tamarind, and mahogany do not reproduce in the shade of old-growth hammocks but rather persist as large individuals only. Large individuals in the upper canopy and a lack of small individuals of these species in the shady interior of the hammock indicate old-growth conditions. Another striking feature of old-growth stands is naked stems of vines hanging from the upper crowns 39 to 49 feet (12 to 15 m) above the forest floor (Simpson 1920). Old growth also has fewer epiphytes than other hammocks because of the very dense shade. Tree snails (*Liguus* spp.) were once native to all hammocks where a closed canopy maintained the moist, shady microclimate required to promote the growth of the fungi and algae upon which they fed. Although not restricted to old growth, tree snails should be present in such stands.

Past History

There are few stands of tropical hardwoods left in Florida undisturbed by humans. The large mastic, mahogany, and other species were selectively harvested for shipbuilding in the 1800's. Because of its toxic effect on humans, poisonwood has been selectively removed from many forests. Wood carvers and collectors have scavenged the downed logs from most areas. Many areas were also cleared for agriculture sometime during the last 300 years. Hammock vegetation will quickly reinvade abandoned areas if fire has not destroyed the organic soil substratum. Many of the trees grow rapidly and can reach heights of 39 feet (12 m) in 25 years. It takes much longer, however, for old-growth characteristics to develop (150 to 200 years).

An example of a stand that meets the minimum qualifications for old growth is Chastain hammock on North Key Largo. Jeanne Parks[1] has observed other stands in the area that also qualify as old-growth hammock vegetation. The best remaining example of old-growth hardwood hammock is on Lignumvitae Key State Botanical Site. Other old-growth stands such as Royal Palm and Mahogany hammocks in Everglades National Park and Castellow and Matheson hammocks in Miami, were severely damaged by Hurricane Andrew and it will take several years for them to recover (Jewell 1993).

[1] Personal communication. 1993. Jeanne Parks, Biologist, Key Largo Hammocks State Botanical Site, P.O. Box 487, Key Largo, FL 33037.

Management Recommendations

Tropical hammocks of south Florida are a unique and important community that humans have severely depleted, primarily by urban development, making management of the remaining areas especially critical. After first protecting the area from future development, the key to maintaining this community is fire control. Fires need to be excluded during the winter months when natural fires rarely occur and hammock soils are dry enough to be totally combusted. Fragmentation of hammocks by power lines, roads, etc., should be avoided also because these artificial openings increase the severity of hurricane damage (Craighead and Gilbert 1962, Craighead 1974). Old-growth hammocks also need to be established across the entire former range of tropical hammocks. This will provide habitat for species that inhabit only certain areas and will increase the probability that some old-growth stands will survive major hurricanes.

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Tropical and subtropical hardwoods form characteristic hammock communities on organic soils overlying the higher areas of limestone bedrock in south Florida, including the Keys, where freezing temperatures occur infrequently. The highly diverse woody vegetation in this community, predominantly of West Indian origin, attains its greatest stature in the Miami area where rainfall is most plentiful. Old-growth stands have a dense, closed canopy with some trees at least 16 inches in diameter and over 100 years old. The dense canopy produces a shady twilight-like interior with a relatively open forest floor. Fairly good examples of old growth with minimal past disturbances remain on Lignumvitae Key and North Key Largo.

Keywords: Everglades, Florida, hammock, old growth, subtropical, tropical.